

What is claimed is:

1 1. A semi-transmissive-type liquid crystal display device
2 comprising:

3 a first substrate including a plurality of signal
4 electrodes being arranged in parallel to one another along a first
5 direction;

6 a second substrate including a plurality of scanning
7 electrodes being arranged in parallel to one another along a
8 second direction orthogonal to said first direction and a
9 plurality of pixel regions each being placed in a one-to-one
10 correspondence to an intersection between each of said signal
11 electrodes and each of said scanning electrodes;

12 a liquid crystal layer inserted between said first
13 substrate and said second substrate;

14 a backlight source to feed light to said liquid crystal
15 layer; and

16 wherein each of said pixel regions includes a reflective
17 region having a reflective film to receive ambient light from an
18 outside and to display in a reflective manner while being in a
19 reflective display mode, and a transmissive region having a
20 transmissive electrode film to allow light from said backlight
21 source to be transmitted to display in a transmissive manner at
22 time of operations in a transmissive display mode; and

23 wherein in each of said pixel regions, said transparent
24 electrode film is extended to said reflective film in a manner
25 to cover at least one part of said reflective film.

1 2. The semi-transmissive-type liquid crystal display device

2 according to Claim 1, wherein said transparent electrode film is
3 formed over said reflective film through an insulating film which
4 is interposed between said transparent electrode film and said
5 reflective film.

1 3. The semi-transmissive-type liquid crystal display device
2 according to Claim 1, wherein said transparent electrode film is
3 formed directly on said reflective film.

1 4. The semi-transmissive-type liquid crystal display device
2 according to Claim 2, wherein said reflective film is electrically
3 connected to said transparent electrode film through a contact
4 hole formed in said insulating film.

1 5. The semi-transmissive-type liquid crystal display device
2 according to Claim 1, wherein in each of said pixel regions, a
3 switching element to turn on or off a voltage signal to be applied
4 to said liquid crystal layer is formed on a surface of said first
5 substrate at a side facing said second substrate and said
6 reflective film is formed in a manner to cover said switching
7 element.

1 6. The semi-transmissive-type liquid crystal display device
2 according to Claim 5, wherein said reflective film covers said
3 switching element with an insulating film having a concave and
4 convex surface being interposed between said reflective film and
5 said switching element.

1 7. The semi-transmissive-type liquid crystal display device

2 according to Claim 5, wherein a contact hole is formed in a manner
3 so as to contact commonly with said insulating film and, in said
4 contact hole, said reflective film and said transparent electrode
5 film are electrically connected to an arbitrary electrode out of
6 a plurality of electrodes making up said switching element.

1 8. The semi-transmissive-type liquid crystal display device
2 according to Claim 5, wherein a first contact hole and a second
3 contact hole are formed in said insulating film and said
4 reflective film is electrically connected to one electrode of said
5 switching element through said first contact hole and said
6 transparent electrode film is electrically connected to one
7 electrode of said switching element through said second contact
8 hole.

1 9. The semi-transmissive-type liquid crystal display device
2 according to Claim 5, wherein a G-D (Gate - Drain) converting
3 portion to draw a signal line used to apply a voltage signal to
4 said liquid crystal layer from a gate layer on said surface of
5 said first substrate at said side of facing said second substrate
6 outside of said transmissive region and said reflective region.

1 10. The semi-transmissive-type liquid crystal display device
2 according to Claim 1, wherein said reflective film is made of a
3 conductive material containing Al (aluminum) or an Al alloy and
4 said transparent electrode film is made of ITO (Indium Tin Oxide).

1 11. A semi-transmissive-type liquid crystal display device
2 comprising:

3 a first substrate including a plurality of signal
4 electrodes being arranged in parallel to one another along a first
5 direction;

6 a second substrate including a plurality of scanning
7 electrodes being arranged in parallel to one another along a
8 second direction orthogonal to said first direction and a
9 plurality of pixel regions each being placed in a one-to-one
10 correspondence to an intersection between each of said signal
11 electrodes and each of said scanning electrodes;

12 a liquid crystal layer inserted between said first
13 substrate and said second substrate;

14 a backlight source to feed light to said liquid crystal
15 layer; and

16 wherein each of said pixel regions includes a reflective
17 region having a reflective film to receive ambient light from an
18 outside and to display in a reflective manner while being in a
19 reflective display mode, and a transmissive region having a
20 transmissive electrode film to allow light from said backlight
21 source to be transmitted to display in a transmissive manner at
22 time of operations in a transmissive display mode; and

23 wherein in each of said pixel regions, a first gap between
24 said first substrate and said second substrate in said reflective
25 region and a second gap between said first substrate and said
26 second substrate in said transmissive region are calibrated so
27 that reflectance or transmittance in white display is maximized
28 according to a twisted angle of said liquid crystal layer.

1 12. The semi-transmissive-type liquid crystal display device
2 according to Claim 11, wherein, when a twisted angle of said liquid

3 crystal is set to about 72°, a calibration is so done that said
4 first gap in said reflective region becomes equal approximately
5 to said second gap in said transmissive region.

1 13. The semi-transmissive-type liquid crystal display device
2 according to Claim 11, wherein, when a twisted angle of said liquid
3 crystal is set to about 0°, a calibration is so done that said
4 first gap in said reflective region is approximately a half of
5 said second gap in said transmissive region.

1 14. The semi-transmissive-type liquid crystal display device
2 according to Claim 11, wherein, when a twisted angle of said liquid
3 crystal is set to about 60°, a calibration is so done that said
4 first gap in said reflective region accounts for approximately
5 70% of said second gap in said transmissive region.

1 15. A method for manufacturing a semi-transmissive-type liquid
2 crystal display device comprising a first substrate including a
3 plurality of signal electrodes being arranged in parallel to one
4 another along a first direction; a second substrate including a
5 plurality of scanning electrodes being arranged in parallel to
6 one another along a second direction orthogonal to said first
7 direction and a plurality of pixel regions each being placed in
8 a one-to-one correspondence to an intersection between each of
9 said signal electrodes and each of said scanning electrodes; a
10 liquid crystal layer inserted between said first substrate and
11 said second substrate; a backlight source to feed light to said
12 liquid crystal layer; and wherein each of said pixel regions
13 includes a reflective region having a reflective film to receive

14 ambient light from an outside and to display in a reflective manner
15 while being in a reflective display mode, and a transmissive
16 region having a transmissive electrode film to allow light from
17 said backlight source to be transmitted to display in a
18 transmissive manner at time of operations in a transmissive
19 display mode, said method comprising:

20 a first process of forming said reflective film making up
21 said reflective region on a surface of said first substrate facing
22 said second substrate; and

23 a second process of forming said transparent electrode film
24 making up said transmissive region in a manner that said
25 transparent electrode film covers part or all of said reflective
26 film.

1 16. The method for manufacturing a semi-transmissive-type
2 liquid crystal display device according to Claim 15, comprising
3 a third process of forming an insulating film on said reflective
4 film to be performed between said first process and said second
5 process.

1 17. The method for manufacturing a semi-transmissive-type
2 liquid crystal display device according to Claim 16, further
3 comprising a fourth process of forming a contact hole to
4 electrically connect said reflective film and said transparent
5 electrode film in said insulating film.

1 18. A method for manufacturing a semi-transmissive-type liquid
2 crystal display device comprising a first substrate including a
3 plurality of signal electrodes being arranged in parallel to one

4 another along a first direction; a second substrate including a
5 plurality of scanning electrodes being arranged in parallel to
6 one another along a second direction orthogonal to said first
7 direction and a plurality of pixel regions each being placed in
8 a one-to-one correspondence to an intersection between each of
9 said signal electrodes and each of said scanning electrodes; a
10 liquid crystal layer inserted between said first substrate and
11 said second substrate; a backlight source to feed light to said
12 liquid crystal layer; and wherein each of said pixel regions
13 includes a reflective region having a reflective film to receive
14 ambient light from an outside and to display in a reflective manner
15 while being in a reflective display mode, and a transmissive
16 region having a transmissive electrode film to allow light from
17 said backlight source to be transmitted to display in a
18 transmissive manner at time of operations in a transmissive
19 display mode, said method comprising:

20 a process of performing a calibration on a first gap between
21 said first substrate and said second substrate in said reflective
22 region and a second gap between said first substrate and said
23 second substrate in said transmissive region so that reflectance
24 or transmittance in white display is maximized according to a
25 twisted angle of said liquid crystal layer by inserting said
26 liquid crystal layer between said first substrate and said second
27 substrate,

28 wherein said first substrate is formed by processes of
29 forming said reflective film making up said reflective region on
30 a surface of said first substrate facing said second substrate
31 and of forming said transparent electrode film making up said
32 transmissive region in a manner that said transparent electrode

33 film covers part or all of said reflective film.

1 19. The method for manufacturing a semi-transmissive-type
2 liquid crystal display device according to Claim 18, wherein a
3 calibration is performed on said first gap between said first
4 substrate and said second substrate in said reflective region and
5 said second gap between said first substrate and said second
6 substrate in said transmissive region so that reflectance or
7 transmittance in white display is maximized according to a twisted
8 angle of said liquid crystal layer by forming said reflective film
9 on a surface of said first substrate facing said second substrate
10 through an insulating film having a concave and convex surface
11 being interposed between said reflective film and said second
12 substrate.

1 20. The method for manufacturing a semi-transmissive-type
2 liquid crystal display device according to Claim 18, wherein a
3 calibration is performed on said first gap between said first
4 substrate and said second substrate in said reflective region and
5 said second gap between said first substrate and said second
6 substrate in said transmissive region so that reflectance or
7 transmittance in white display is maximized according to a twisted
8 angle of said liquid crystal layer by processing a surface of said
9 first substrate facing said second substrate.

1 21. The method for manufacturing a semi-transmissive-type
2 liquid crystal display device according to Claim 19, wherein a
3 thickness of said insulating film is made different between said
4 transmissive region and said reflective region.